

CLAIMS

What is claimed is:

1. An ultrasonic medical device comprising:

an ultrasonic probe having a proximal end, a distal end and a longitudinal axis between the proximal end and the distal end; and

a horn assembly having a distal end engaged to the proximal end of the ultrasonic probe through a coupling assembly,

wherein the coupling assembly transmits an ultrasound energy from the horn assembly to the ultrasonic probe.

10 2. The ultrasonic medical device of claim 1 wherein the horn assembly amplifies the ultrasound energy.

3. The ultrasonic medical device of claim 1 wherein the coupling assembly reflects a substantial portion of the ultrasound energy back into the horn assembly.

15 4. The ultrasonic medical device of claim 1 wherein the ultrasound energy is transmitted along the longitudinal axis of the ultrasonic probe, causing the ultrasonic probe to vibrate in a direction transverse to the longitudinal axis of the ultrasonic probe, producing a plurality of nodes and anti-nodes along a portion of the longitudinal axis of the ultrasonic probe.

20 5. The ultrasonic medical device of claim 1 further comprising an ultrasound energy source engaged to the horn assembly.

6. The ultrasonic medical device of claim 1 wherein the coupling assembly presents an impedance mismatch between the horn assembly and the ultrasonic probe.

25 7. The ultrasonic medical device of claim 1 wherein the coupling assembly allows rapid attachment and detachment of the ultrasonic probe and an ultrasound energy source engaged to the horn assembly.

8. The ultrasonic medical device of claim 1 wherein the horn assembly stores ultrasound energy.
9. The ultrasonic medical device of claim 1 wherein the coupling assembly comprises a quick attachment-detachment collet.
- 5 10. The ultrasonic medical device of claim 8 wherein the quick attachment-detachment collet is housed within an externally mounted compressive clamp capable of exerting a compressive force on the quick attachment-detachment collet after insertion of the ultrasonic probe into the quick attachment-detachment collet.
- 10 11. The ultrasonic medical device of claim 8 wherein the quick attachment-detachment collet applies a restraining inwardly compressive force on the ultrasonic probe.
12. The ultrasonic medical device of claim 1 wherein a head segment at the proximal end of the ultrasonic probe is inserted into a cylindrical slot of the horn assembly.
- 15 13. The ultrasonic medical device of claim 1 wherein a locking nut engages the horn assembly to the ultrasonic probe by engaging screw threads of the locking nut and complimentary threads on the horn assembly.
14. The ultrasonic medical device of claim 1 wherein a flexibility of the ultrasonic probe allows movement of the ultrasonic probe through a narrow, tortuous vessel.
- 20 15. The ultrasonic medical device of claim 1 further comprising a sheath surrounding at least a portion of the ultrasonic probe.
16. The ultrasonic medical device of claim 1 wherein the ultrasonic probe is an elongated wire.
17. An ultrasonic medical device for removing endovascular material comprising:

- an elongated probe having a proximal end, a distal end and a longitudinal axis between the proximal end and the distal end;
- a horn assembly engaging the proximal end of the elongated probe;
- a coupling assembly engaging the proximal end of the elongated probe to
5 a distal end of the horn assembly,
- wherein the horn assembly amplifies an ultrasound energy and transmits
the ultrasound energy to the elongated probe, producing a transverse
ultrasonic vibration along at least a portion of the longitudinal axis of the
elongated probe and generating a plurality of transverse vibration anti-
nodes along at least a portion of the longitudinal axis of the elongated
10 probe.
18. The ultrasonic medical device of claim 17 further comprising an ultrasound
energy source engaging the horn assembly.
19. The ultrasonic medical device of claim 17 wherein the coupling assembly
15 presents an impedance mismatch between the horn assembly and the elongated
probe.
20. The ultrasonic medical device of claim 17 wherein the coupling assembly reflects
a substantial portion of the ultrasound energy back into the horn assembly.
21. The ultrasonic medical device of claim 17 wherein the horn assembly stores the
20 ultrasound energy.
22. The ultrasonic medical device of claim 17 wherein a head segment at the
proximal end of the elongated probe is inserted into a cylindrical slot of the horn
assembly.
23. The ultrasonic medical device of claim 17 wherein a locking nut engages the horn
25 assembly to the elongated probe by engaging screw threads of the locking nut and
complimentary threads on the horn assembly.

24. The ultrasonic medical device of claim 17 wherein the coupling assembly comprises a quick attachment-detachment collet.
25. The ultrasonic medical device of claim 24 wherein the quick attachment-detachment collet is housed within an externally mounted compressive clamp capable of exerting a compressive force on the quick attachment-detachment collet after insertion of the elongated probe into the quick attachment-detachment collet.
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26. A method of ablation of an endovascular material in a vessel comprising:
 - inserting an ultrasonic probe into the vessel;
 - 10 moving the ultrasonic probe within the vessel to a site of the endovascular material;
 - engaging a horn assembly to the ultrasonic probe with a coupling assembly;
 - 15 activating an ultrasound energy source engaged to the horn assembly to transmit ultrasound energy to the horn assembly;
 - amplifying the ultrasound energy with the horn assembly; and
 - transmitting the ultrasound energy to the ultrasonic probe to produce a transverse ultrasonic vibration along at least a portion of a longitudinal axis of the ultrasonic probe, producing a plurality of transverse anti-nodes
20 along at least a portion of the longitudinal axis of the ultrasonic probe.
27. The method of claim 26 further comprising disengaging the horn assembly from the ultrasonic probe after the ablation of the endovascular material.
28. The method of claim 26 further comprising surrounding at least a portion of the longitudinal axis of the ultrasonic probe with a sheath.

29. The method of claim 26 further comprising inserting a head segment at a proximal end of the ultrasonic probe into a cylindrical slot of the horn assembly and engaging the horn assembly to the ultrasonic probe by engaging screw threads of a locking nut surrounding the head segment onto complimentary threads on the horn assembly.
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30. The method of claim 26 further comprising inserting the ultrasonic probe into the vessel with a flexibility that does not damage the vessel.
31. The method of claim 26 further comprising providing the coupling assembly has a quick attachment-detachment collet.
- 10 32. The method of claim 31 further comprising housing the quick attachment-detachment collet within an externally mounted compressive clamp capable of exerting a compressive force on the quick attachment-detachment collet after insertion of the ultrasonic probe into the quick attachment-detachment collet.
33. The method of claim 28 further comprising providing the ultrasonic probe is a wire.
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